ANNUAL REPORT 1964

MARKHAM
VILLAGE

water pollution control plant

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SEP 13 1965
ONTARIO WATER
RESOURCES COMMISSION

DIVISION OF PLANT OPERATIONS
Ontario Water Resources Commission

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ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

Members of the Markham Village Local Advisory Committee,
Village of Markham.

Gentlemen:

We are pleased to provide you with the 1964 Operating Report for the Markham Village Water Pollution Control Plant, OWRC Projects Nos. 59-S-40 and 60-S-55.

By continuing the mutual cooperation which has existed in the past, we can look forward to greater progress in the field of water pollution control.

Yours very truly,

D. S. Caverly, P. Eng.,
General Manager

General Manager,
Ontario Water Resources Commission.

Dear Sir:

It is with pleasure that I present to you the Annual Report of the operation of the Markham Village Water Pollution Control Plant, OWRC Projects Nos. 59-S-40 and 60-S-55 for 1964.

This report presents design data, outlines operating problems encountered and summarizes in tables, charts and graphs all significant flow and cost data.

Yours very truly,

B C Palmer

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

This report describes the operation of this project for the year 1964. It includes a detailed description of the project, summary of operation, graphs and charts showing quality and quantity information, and project cost data.

This information will be of value to the municipality in assessing the adequacy of the works in meeting existing requirements and in projecting its capability to meet future expected demands. The cost information will be of particular interest to those concerned with developing and maintaining revenue structures.

The preparation of this report has been a cooperative effort of several groups within the Division of Plant Operations. These include the Statistical Section, Brochures Officer and the Regional Supervisor. However, the primary responsibility for the content has been with the Regional Operations Engineer. He will be pleased to discuss all aspects of this report with the municipality.

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

CONTENTS

Foreword 1

Title Page 3

'64 Review 4

Glossary 5

History 6

Project Staff 7

Description of Project 8

Project Costs 10

Plant Flow Chart 13

Design Data 14

Process Data 18

MARKHAM VILLAGE

water pollution control plant

operated for

THE VILLAGE OF MARKHAM

by the

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W. S. MacDonnell

DIVISION OF PLANT OPERATIONS

DIRECTOR: B. C. Palmer

Assistant Director: C. W. Perry
Regional Supervisor: A. C. Beattie
Operations Engineer: A. Clark

801 Bay Street — Toronto 5

'64 REVIEW

This report gives in detail the available significant data on the operation of the various treatment units of the Markham Village Water Pollution Control Plant.

The final effluent quality did not always meet the OWRC objectives of 15 ppm BOD and 15 ppm SS due to varying flow characteristics and interfering industrial wastes.

GLOSSARY

BOD	biochemical oxygen demand (a measure of organic content)
cfm	cubic feet per minute
comminution	shredding of solids into small fragments
DWF	dry weather flow
effluent	outflow
flocculation	bringing very small particles together to form a larger mass (the floc) before settling
fps	feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
grit	sand, dust, stones, cinders and other heavy inorganic material
influent	inflow
lin. ft.	lineal feet
mgd	million gallons per day
mlss	mixed liquor suspended solids
ppm	parts per million
ss	suspended solids
TDH	total dynamic head (usually refers to pressure on a pump when it is in operation)

HISTORY
1958 - 1964

INCEPTION

In 1958, the Village of Markham and the Ontario Water Resources Commission initiated plans for the construction of a modern sewage treatment plant.

The firm of R. V. Anderson and Associates Limited, Toronto, Ontario was engaged to prepare plans and specifications for the project.

APPROVAL

In July 1959, the village signed an agreement with the Ontario Water Resources Commission to finance, construct and operate the plant, OWRC Project 59-S-40. There was another agreement signed in February 1960 for the construction and operation of a sewage pumping station on the plant property and the West Rouge trunk sewer, OWRC Project 60-S-55.

CONSTRUCTION

Pearce Construction Limited, Hagersville, Ontario, began construction of the plant in September 1959 and in December 1960 the Division of Plant Operations took over the operation.

Swansea Construction Company Limited, Toronto, Ontario commenced construction of the pumping station and sewer in December 1960 and in July 1961 this also came under the control of the Division of Plant Operations.

TOTAL COSTS

The combined total cost of the two projects, 59-S-40 and 60-S-55, was $840,329.00.



I. BARON
CHIEF OPERATOR

Project Staff

Operator:

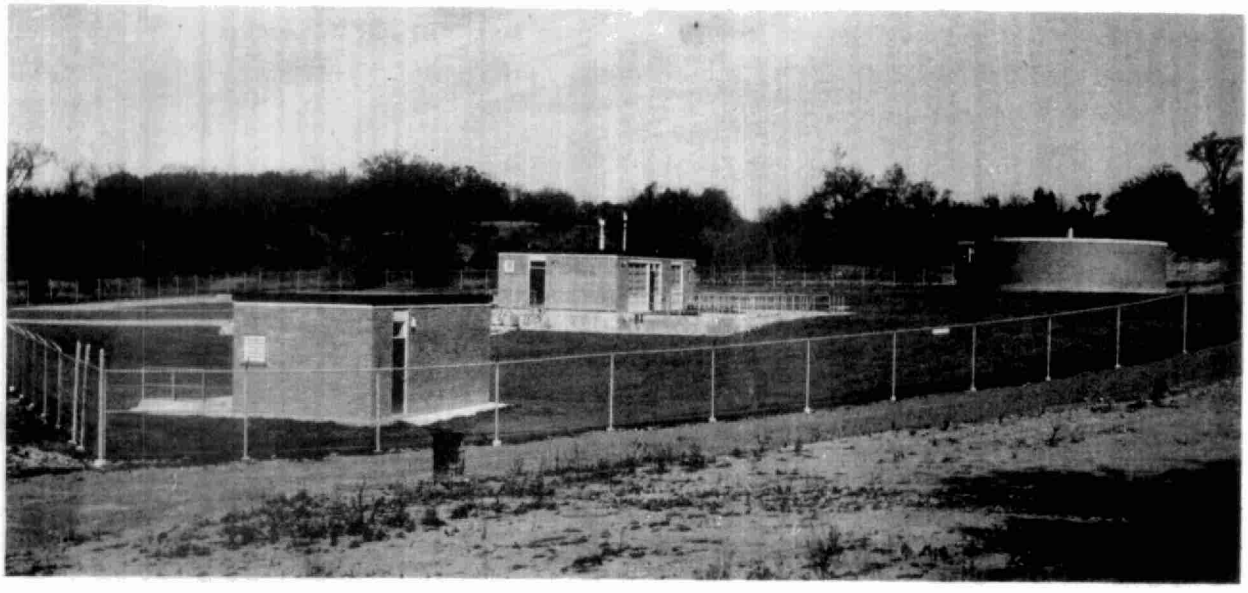
E. Brophy

COMMENTS

The Markham Village Sewage Treatment Plant is presently under eight hour supervision per day. The plant has a complement of two men, the Chief Operator, Mr. I. E. Baron, and Operator, Mr. E. C. Brophy.

Both men were hired as a result of interviews conducted by the Village of Markham and OWRC officials on November 24th, 1960. Mr. Baron, formerly a Commission employee at the Markham Township water pumping station, commenced employment at the sewage plant on February 1st, 1961 while Mr. Brophy commenced work on February 13th, 1961. Both men have shown that they are capable of operating the plant efficiently and economically.

Both Mr. Baron and Mr. Brophy have successfully completed the Senior Sewage Operators' course offered by the Ontario Water Resources Commission and have been awarded the OWRC Senior Course Certificate.



Description of Project

PUMPING MANHOLES

There are two temporary pumping manholes on the sanitary sewer system. These manholes will not be required once the system's expansion program is completed as the sewage then flows by gravity to the plant site.

RAW SEWAGE LIFT STATION

The West Rouge trunk sewer which serves the westerly portion of Markham Village empties into the wet well portion of the raw sewage lift station approximately 35 feet below normal plant elevation. The sewage is then pumped to the influent works by either one of two vertical dry well centrifugal pumps after first passing through a bar screen.

INFLUENT WORKS

The influent works at the plant provide for screening, shredding and grit removal. The screening and shredding is accomplished as the sewage passes through a 18" model C Barminutor. Grit is removed from the sewage by means of an air degrittor. Both these units are provided with bypass channels, the barminutor bypass being equipped with a coarse bar screen.

The sewage after passing through the air degrittor flows to the primary sedimentation tank which is designed to provide an adequate detention period to allow the heavier solids to settle out, and for the removal of surface scum and grease.

The primary sedimentation tank is equipped with longitudinal sludge collectors which serve as skimming mechanisms for removal of surface material and for transferring settled sludge to a point from which it may be pumped directly to the digester.

The primary tank is designed to provide a detention period, sufficient to remove approximately 30-35% of the heavy organic material.

The settled waste water flows over the effluent weirs and discharges into the aeration tank.

AERATION

The flow upon entering the aeration tank undergoes another detention period which provides the biological environment required to remove the finely divided, suspended and dissolved organic materials remaining in the flow

The settled sludge (activated sludge), from the final sedimentation tank, is recirculated back to the aeration tanks, and mixes with the incoming effluent from the primary tanks. This mixed liquid is then aerated by air which is supplied from a compressor. The air supplied provides the oxygen requirements of the biological communities of aerobic microorganisms (mixed liquor sludge floc) and also produces a roll which prevents settling in the tanks. The activated sludge which is returned acts as the vehicle for the bacteria which in turn oxidizes the organic material contained in the water.

The mixed liquor then passes into the final settling tanks.

FINAL SEDIMENTATION

The final sedimentation tank provides a detention period to allow remaining activated sludge solids to settle out. The activated sludge is returned to the aeration tank to provide the continuous environment for the maintenance of the floc in the aeration section.

The final sedimentation tank is equipped with chain drive sludge collectors which collect the sludge to a central point from which it is returned to either the primary sedimentation tank or the aeration tank.

DIGESTION

The sludge and scum collected in the primary sedimentation tank is pumped to the digester. In the absence of air, and in a regulated temperature of 90 degrees Fahrenheit, the decomposing or digestion process begins. Constant agitation within the tank ensures overall treatment.

The raw sludge is broken down by anaerobic bacterial action and, when thoroughly digested, is a thick, black odourless liquid.

Sludge gas (principally methane), formed during the process, is used as a fuel to heat the digester. In the absence of sufficient methane gas, oil is used to heat the digester.

CHLORINATION

The chlorinator injects chlorine into the final effluent to reduce the bacterial count to acceptable limits.

CONTROL BUILDING

The control building houses an office and laboratory, as well as the following equipment.

Main control panel, chlorinator, air blower, raw sludge pump, return activated sludge pump, standby pump, a water seal unit and a heat exchanger. A small work shop is also provided. Equipment required in future expansion of the plant may also be housed in the control building.

PROJECT COSTS

(59-S-40 only)

LONG TERM DEBT: (Total Capital Cost)	$608,711.00

The total cost to the municipality during 1964 was as follows:

Net Operating	$ 15,120.53
Debt Retirement	12,284.00
Reserve	4,184.00
Interest Charged	34,246.30
TOTAL	$ 65,834.83

RESERVE ACCOUNT

Balance at January 1, 1964	$ 12,404.74
Deposited by municipality	4,184.00
Interest Earned	772.64
	$
Less Expenditures	-
Balance at December 31, 1964	$ 17,361.39

DEBT OUTSTANDING:	$554,182.95

MONTHLY COSTS

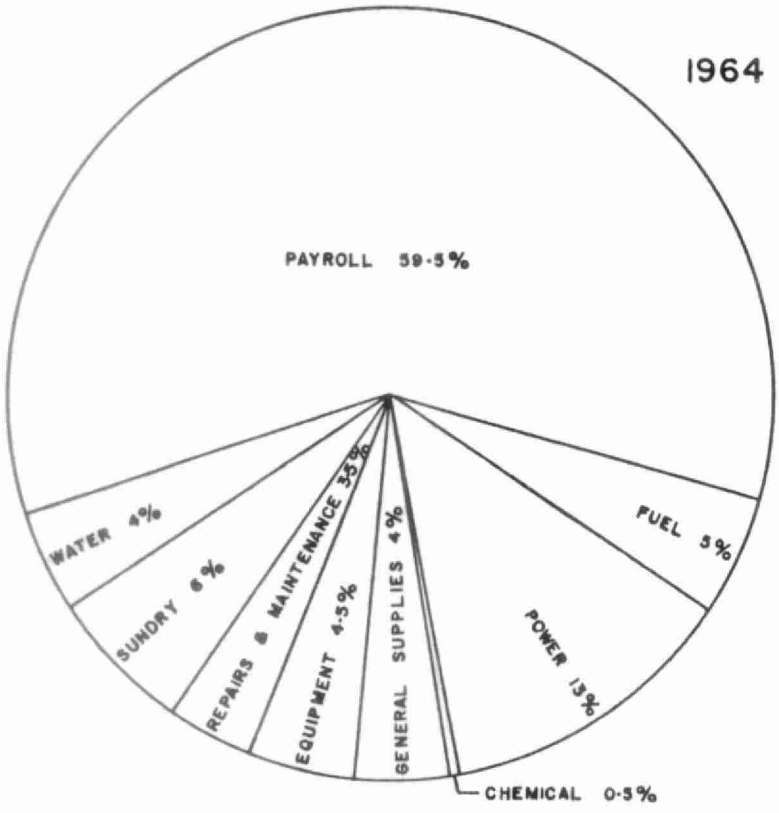
MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	*BUNDRY	WATER
JAN	856.30	657.06			157.87		35.37			6.00	
FEB	1013.63	657.06		79.56	167.38		61.43	19.78		19.19	9.23
MARCH	1138.60	657.06		168.63	166.59		77.24	13.98		55.10	
APRIL	1263.80	765.24		209.53	156.33		43.02		14.80	23.99	50.89
MAY	1620.85	1027.23		89.35	153.27	224.03	60.44		30.39	36.14	
JUNE	1201.03	769.47		107.73	143.04		59.77		41.00	19.49	60.53
JULY	1132.71	684.82			140.94		64.11		214.35	28.49	
AUG	1012.45	684.82			145.39		30.13			24.09	128.02
SEPT	1039.52	684.82			135.77		21.94	27.04	17.07	152.88	
OCT	1677.59	684.82		125.11	148.91	224.03	24.77	53.74	194.07	22.84	199.30
NOV	959.68	684.82			138.86		71.01	16.80	18.70	29.49	
DEC	2204.37	1027.23			291.72	(385.00)	68.76	556.15	6.08	504.81	134.62
TOTAL	15120.53	8984.45		779.91	1946.07	63.06	617.99	687.49	536.46	922.51	582.59

BRACKETS INDICATE CREDIT

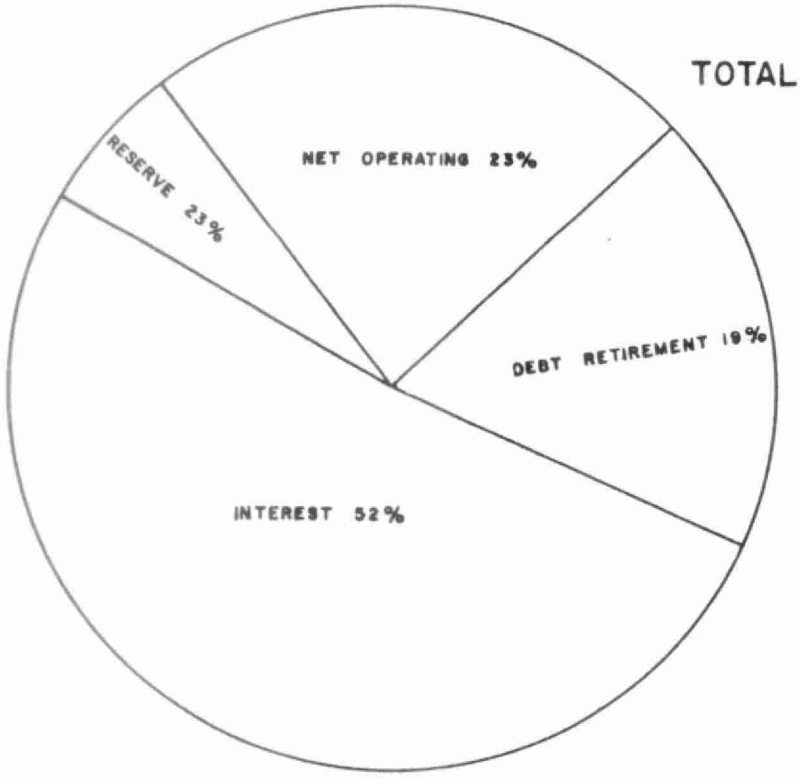
YEARLY COSTS

YEAR	M.G. TREATED	TOTAL COST	COST PER FAMILY PER YEAR	COST PER MILLION GALLONS	COST PER L.B. OF BOD REMOVED
1961	27.375	14395.33	13.03	525.85	23 CENTS
1962	45.625	15920.73	13.57	348.94	14 CENTS
1963	60.225	16771.42	12.40	278.00	11 CENTS
1964	84.180	15120.53	10.34	179.62	7 CENTS

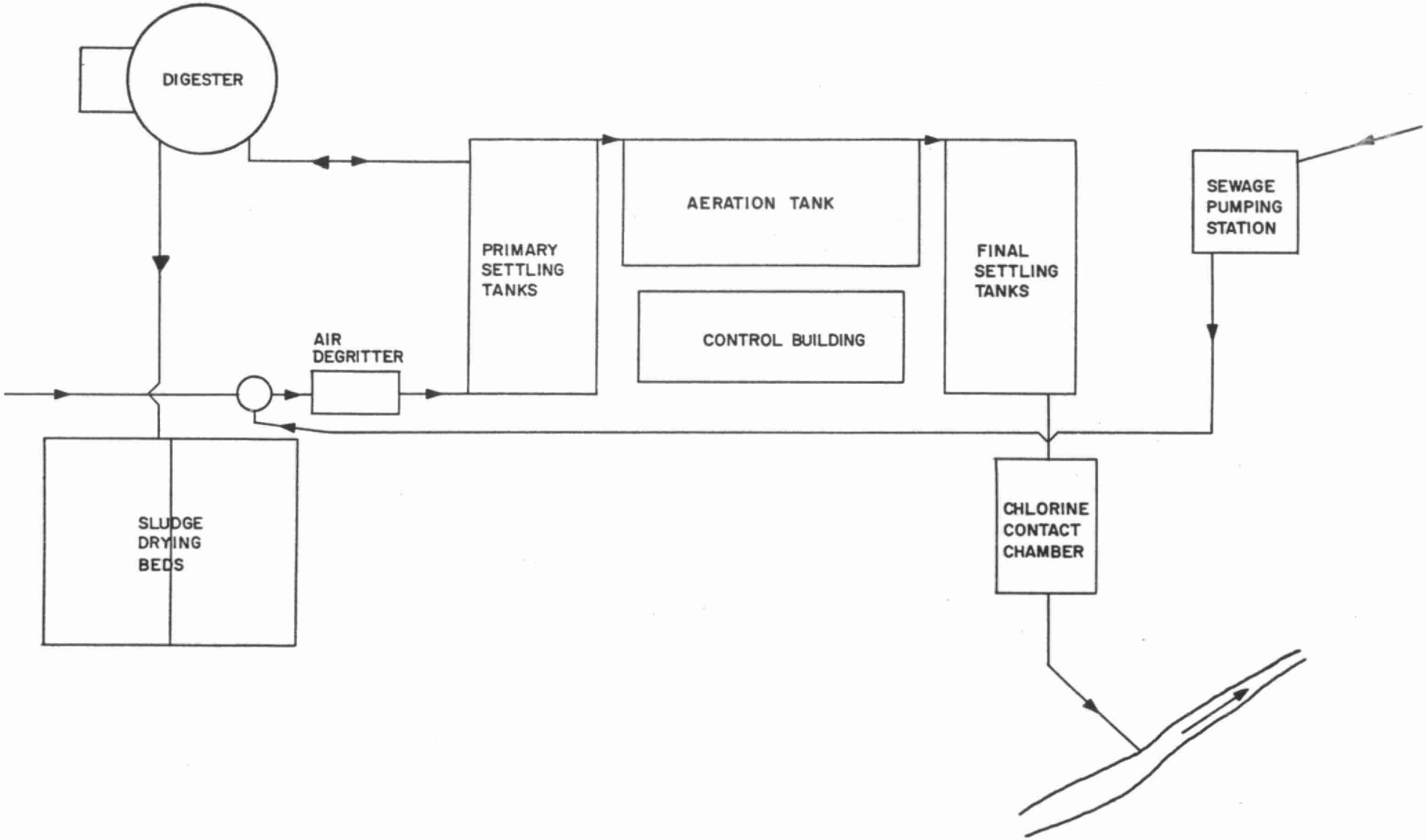
1964 OPERATING COSTS



TOTAL ANNUAL COST



Technical Section


DIGESTER
PRIMARY SETTLING TANKS
AERATION TANK
FINAL SETTLING TANKS
SEWAGE PUMPING STATION
AIR DEGRITTER
CONTROL BUILDING
SLUDGE DRYING BEDS
CHLORINE CONTACT CHAMBER

Design–Data

GENERAL

Type of Plant - Activated Sludge.

Design Population - 4,000 persons.

Design Plant Flow - 334,000 gallons per day.

Per Capita Flow - 83.5 gallons per day.

Five Day BOD -

Raw Sewage	-	215 PPM
Removal	-	95%

Suspended Solids -

Raw Sewage	-	250 PPM
Removal	-	95%

PUMPING STATION

Screen

One and one-quarter inch x 5/16 inch galvanized steel bars at 1 1/2 inch centres.

Raw Sewage Well

Size - 21.42 ft. x 9.75 ft. x 6 ft. (maximum depth).

- sloped bottom to pump suctions.

Volume - approximately 975 cubic feet, or 6,080 gallons.

Raw Sewage Lift Pumps

Two Fairbanks-Morse vertical centrifugal pumps, each rated at 350 GPM at a head of 40 ft. and each driven by a 20 HP Westinghouse electric motor.

Screen and Shredder

Barminutor - Chicago Pump Company - Model - C9.

Screen - on bypass channel around barminutor - 1 1/4 inch x 3/16 in. bars at 1 in. centres.

Aerated Grit Tank

Size - 13 ft. x 6 ft. x 8.13 ft. SWD - hopper bottom.

Volume - 680 cubic feet, or 4,240 gallons (Including hopper).

Retention - 18.35 minutes at 333,000 GPD.

- 7.36 minutes at 833,000 GPD (2.5 DWF).

Grit Decanting Trough

Four pass with each channel being 5.5 ft. x 1 ft. x 1.75 ft. (to top of wall).

Bypass - aerated grit tank can be completely bypassed.

Primary Settling Tank

Size - 42 ft. x 12 ft. x 7.75 ft. (average liquid depth.)

Volume - 3,905 cubic feet, or 24,400 gallons.

Retention - 1.76 hours at 333,000 GPD.

- 0.71 hours at 833,000 GPD (2.5 DWF).

Surface Settling Rate - 661 gallons per square ft. per day at 333,000 GPD. 1650 gallons per square ft. per day at 833,000 GPD (2.5 DWF).

Weir Overflow Rate - 27,800 gallons per lineal ft. of weir per day at 333,000 GPD.

69,400 gallons per lineal ft. of weir per day at 833,000 GPD (2.5 DWF).

Raw Sludge Pump

1 - Wemco-Torque flow pump rated at a maximum of 150 U.S. GPM at a head of 28.5 ft. and driven by a 5 HP U. S. Varidrive electric motor.

Aeration Tank

Size - 51 ft. x 22 ft. x 15 ft. (SWD).

Volume - 16,810 cubic feet, or 105,000 gallons.

Retention - 7.57 hours @ 333,000 GPD (no return sludge).

- 6.06 hours @ 416,250 GPD (25% return sludge).

- 100 Sparjers

Blowers

1 - Sutorbilt Corp. (Size - 12 x 11, Disp. 1.5) blower rated at approximately 370 cfm at 5 psi and driven by a 30 HP Leland-Newman eletric motor.

1 - Burgess-Manning snubber.

Secondary Settling Tank

Size - 42 ft. x 12 ft. x 10.5 ft. (average liquid depth).

Volume - 5,290 cubic feet, or 33,000 gallons.

Retention - 2.38 hours @ 333,000 GPD (no return sludge).

- 1.91 hours @ 416,250 GPD (25% return sludge).

Surface Settling Rate - 661 gallons per square ft. per day @ 333,000 gpd.

Weir Overflow Rate - 4,750 gallons per lineal ft. of weir per day @ 333,000 gpd.

Return Sludge Pump

1 - Fairbanks-Morse vertical centrifugal pump rated at a maximum of 150 GPM at a head of 18 ft. and driven by a 2 HP U. S. Varidrive electric motor.

Chlorine Contact Chamber (3 round-the-end baffles)

Size - 20 ft. x 11.38 ft. x 8.5 ft. (SWD).

Volume - 1,935 cubic feet, or 12,080 gallons.

Retention - 52.2 minutes @ 333,000 gpd.

Chlorinator

1 - Wallace and Tiernan V-notch Variable - Orifice gas chlorinator with a range of 0 to 40 pounds of chlorine per 24 hours.

Digester

Size - 45 ft. in diameter x 20 ft. (SWD).

Volume - 35,240 cubic feet, or 220,000 gallons.

Digester Contents Recirculating Pump

1 - Fairbanks-Morse horizontal centrifugal pump rated at 150 gpm and driven by a 3 HP Westinghouse electric motor.

Heat Exchanger

1 - Pacific Flush Tank Company heat exchanger which can burn either oil or sludge gas.

Sludge Drying Beds

Size - 4 each 90 ft. x 20 ft.

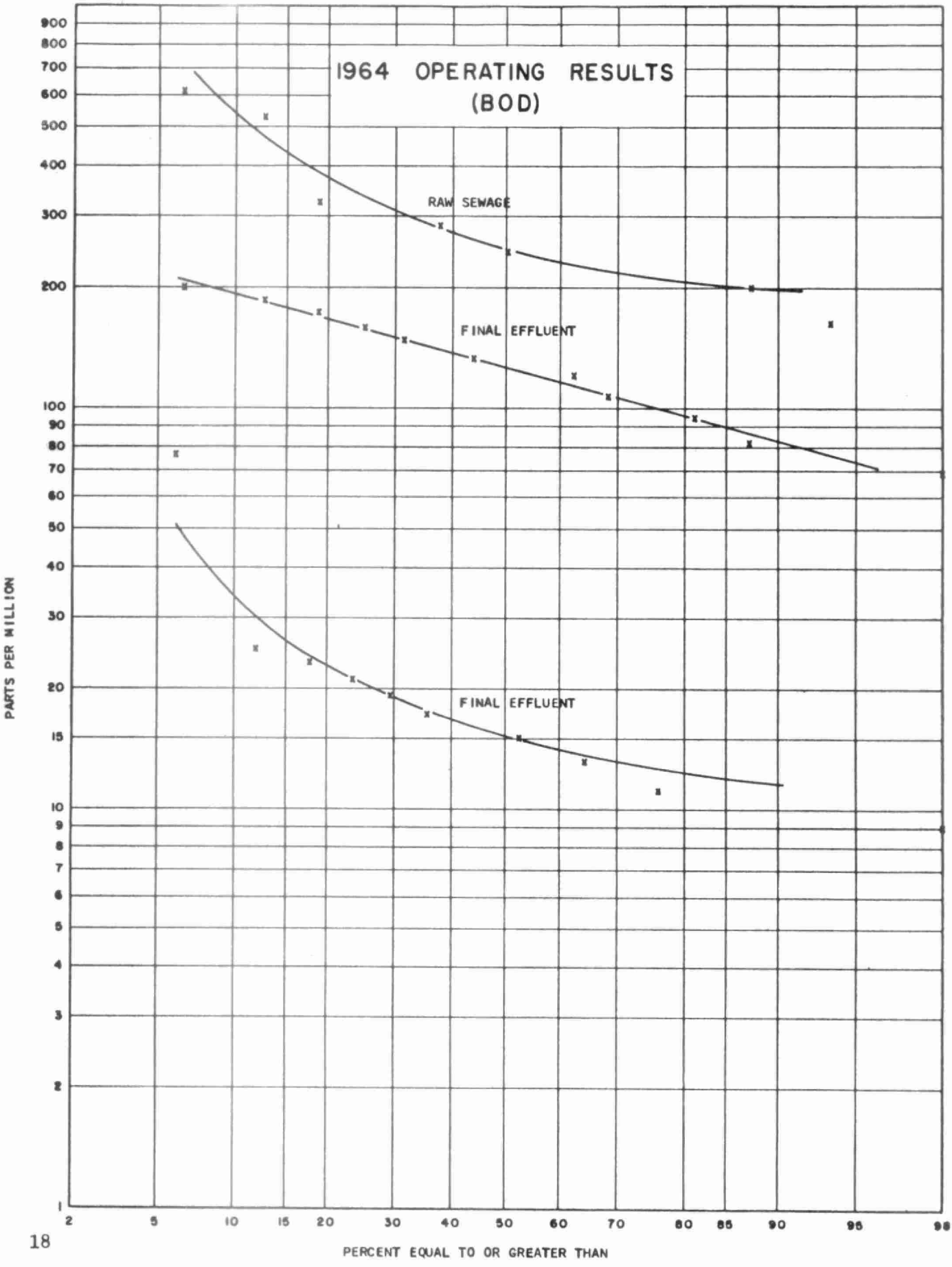
Area - 7,200 square feet.

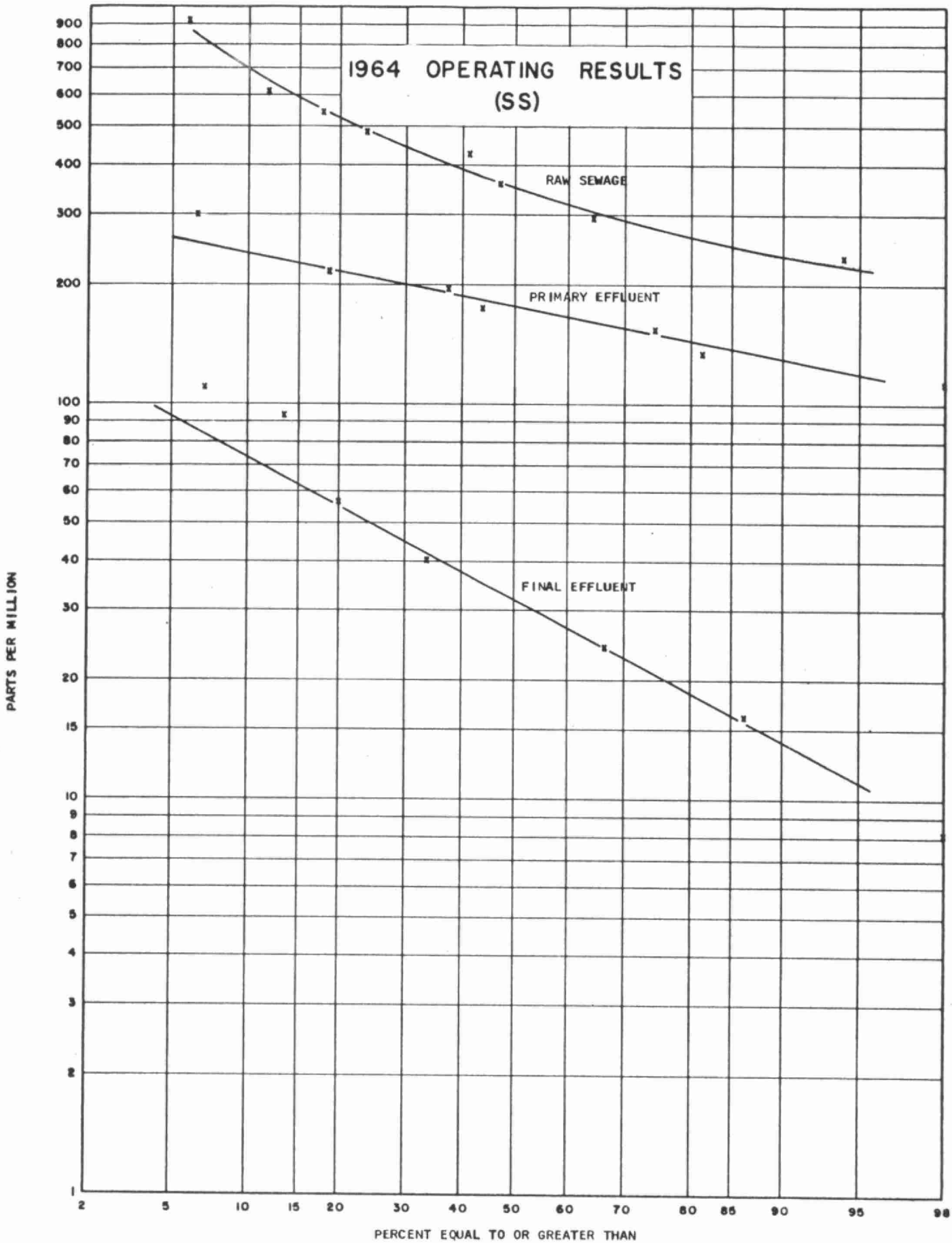
Capacity - 1.8 square feet per capita @ 4,000 persons.

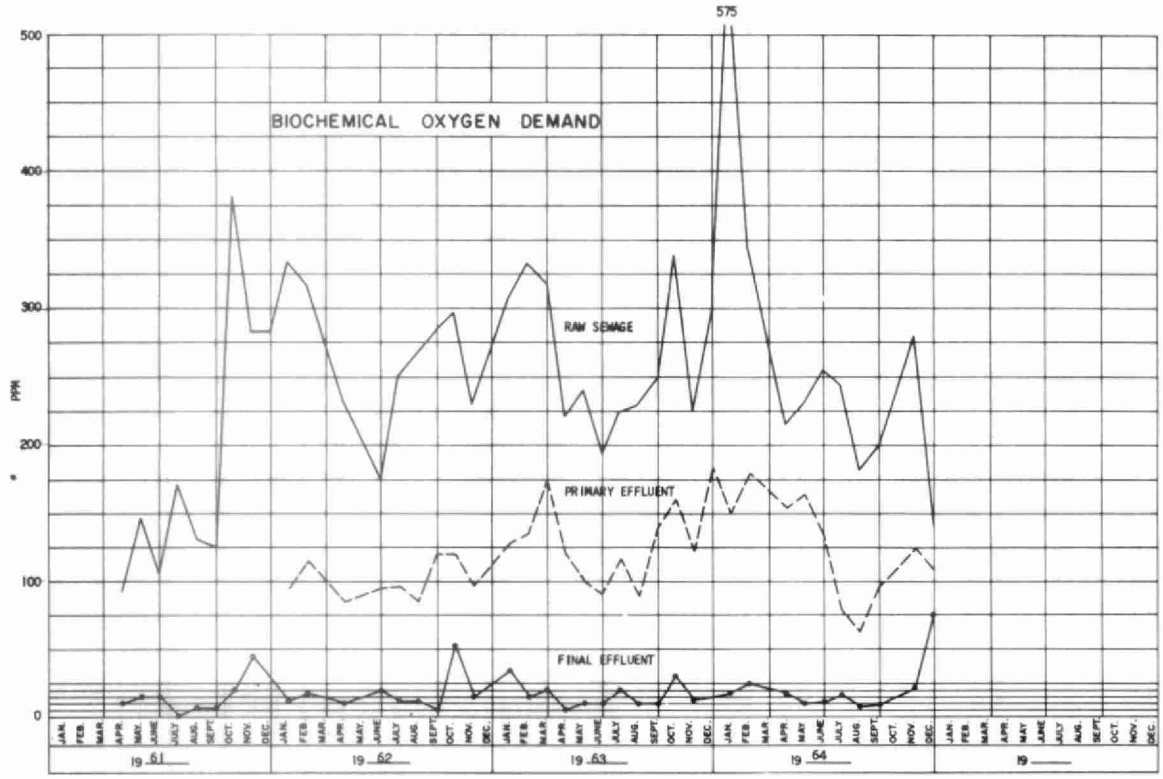
Flow Meter

1 - Foxboro (model 40) totalizer, recorder and indicator to operate from a 9-inch Parshall flume.

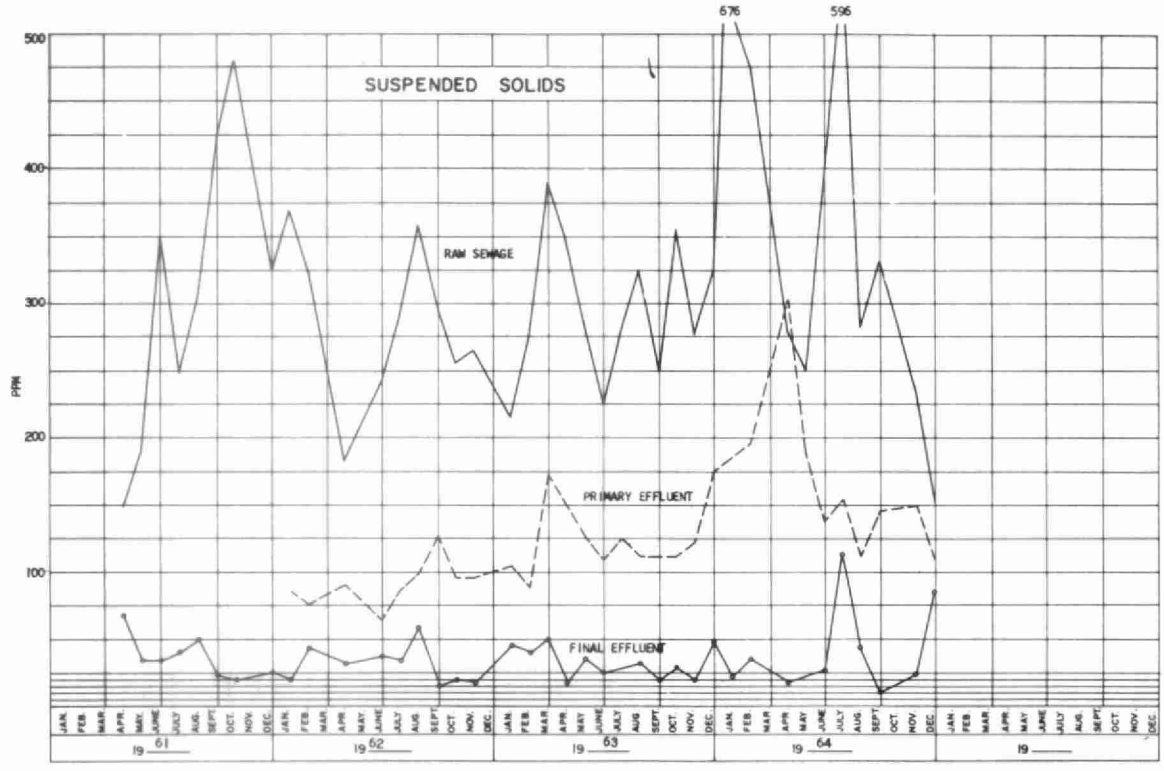
Process Data




1964 OPERATING RESULTS
(SS)
RAW SEWAGE
PRIMARY EFFLUENT
FINAL EFFLUENT
PARTS PER MILLION
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
15
10
9
8
7
6
5
4
3
2
1
2
5
10
15
20
30
40
50
60
70
80
85
90
95
98
PERCENT EQUAL TO OR GREATER THAN



MONTHLY VARIATIONS



GRIT, B.O.D AND S.S. REMOVAL

MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	
JAN.	575	18	97.0	19.8	676	22	96.5	23.3	8
FEB.	340	25	92.5	10.5	476	36	92.5	14.7	8
MAR.	245	24	90.0	7.9	532	16	97.0	18.4	8
APR.	215	18	91.5	6.8	276	54	80.5	7.6	8
MAY	232	12	95.0	7.8	250	23	91.0	8.1	23
JUNE	255	12	95.0	8.4	396	26	93.5	12.8	18
JULY	245	16	93.5	8.2	596	114	81.0	17.2	45
AUG.	182	9	95.0	6.2	283	42	85.0	8.6	12
SEPT.	198	10	95.0	6.5	332	10	97.0	11.1	12
OCT.	*264	22	91.5	8.6	*382	45	88.0	12.0	14
NOV.	280	21	92.5	8.9	232	62	73.0	5.8	-
DEC.	136	78	42.5	2.1	152	89	41.5	2.2	10
TOTAL	-	-	-	101.9	-	-	-	141.8	166
AVG.	264	22	91.5	8.5	382	45	88.0	11.8	14

* average values - loadings based on estimated daily flow of . 230 mgd.

COMMENTS

The chart shows an average BOD and suspended solids concentration of 264 ppm and 382 ppm respectively. The percentage removal of 91. 5 percent BOD and 88 percent suspended solids are considered satisfactory in light of the rather strong sewage being treated. Although the percentage removal is satisfactory, the final effluent exceeds the OWRC standard 15 ppm of BOD and suspended solids concentration by 7 ppm and 30 ppm respectively.

DIGESTER OPERATION

MONTH	SLUDGE TO DIGESTERS			SLUDGE FROM DIGESTERS			GAS PRODUCED 1000'S Cu. Ft.
	1000'S CU.FT.	% SOLIDS	% VOL. MAT.	1000'S CU. FT.	% SOLIDS	% VOL. MAT	
JAN.	8.08	-	-	-	-	-	-
FEB.	7.44	-	-	-	-	-	-
MAR.	6.15	-	-	1.34	-	-	-
APR.	7.69	4.37	-	1.31	4.93	-	-
MAY	7.95	-	-	-	-	-	-
JUNE	7.69	-	-	2.70	-	-	-
JULY	7.95	5.95	2.00	2.75	3.80	3.11	-
AUG.	7.95	-	-	2.56	-	-	-
SEPT.	7.69	-	-	1.40	8.02	-	-
OCT.	7.95	-	-	2.70	-	-	-
NOV.	7.69	-	-	-	-	-	-
DEC.	7.95	-	-	1.43	-	-	-
TOTAL	92.18	-	-	16.19	-	-	-
AVG.	7.68	5.16	2.00	1.35	5.58	3.11	-

COMMENTS

The chart indicates that 92,180 cubic feet of sludge was pumped to the digester while only 16,190 cubic feet was hauled from the plant by truck. This represents a volume reduction of 82.5 percent. This figure is gained by the use of the sludge drying beds in the plant. The figure of percent solids sludge from the digester is obtained before drying in the sludge beds.

CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (P.P.M)
JANUARY	7.130	-	-
FEBRUARY	6.670	-	-
MARCH	7.130	-	-
APRIL	6.900	-	-
MAY	7.130	155	2.17
JUNE	6.900	301	4.36
JULY	7.130	323	4.53
AUGUST	7.130	336	4.71
SEPTEMBER	6.900	338	4.90
OCTOBER	7.130	386	5.41
NOVEMBER	6.900	356	5.16
DECEMBER	7.130	*262	4.75
TOTAL	84.180	2457	-
AVERAGE	7.015	307	4.49

* 24 days
flow estimates based on .230 mgd.

COMMENTS

The average chlorine dosage of 4.49 ppm is normal for an activated sludge water pollution control plant.

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CONCLUSIONS

Treatment throughout the year was reasonably satisfactory. On the occasions when the BOD of the effluent exceeded Ontario Water Resources Commission objectives the strength of the raw sewage was greater than that for which the plant was designed (210 ppm BOD).

Although the daily average flow is less than the design flow of 0.330 mgd the instantaneous flows were often much greater than the design flow.

No major changes in process are anticipated in 1965.

RECOMMENDATIONS

With the strong sewage now being treated and the prospect of increased flows in the future, it is anticipated that plant expansion will be required soon.




ONTARIO WATER RESOURCES COMMISSION